X-Craft

Summary Brief

Office of Naval Research

30 July 2003

X-Craft Summary

Purpose:

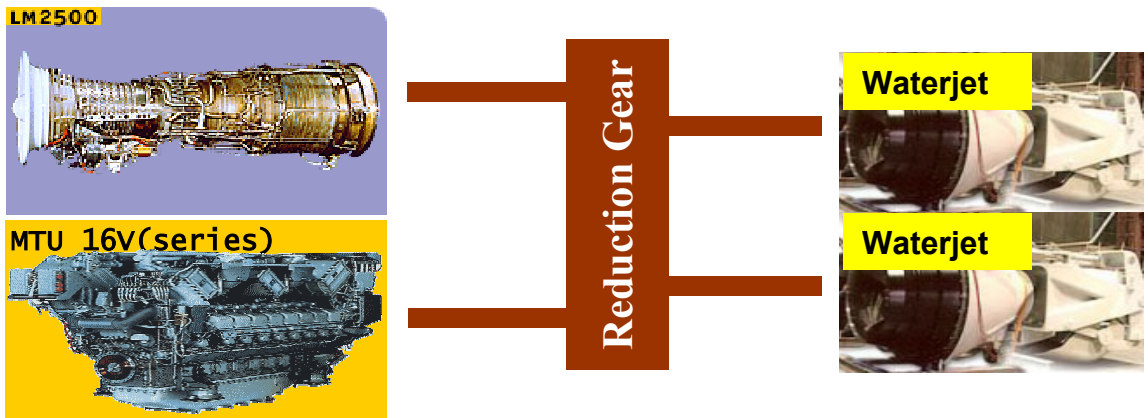
- Experimental platform evaluating the hydrodynamic performance, structural behavior and propulsion system efficiency of high speed hull form technologies
- Evaluate mission modularity

Science & Technology:

- Hydrodynamic experimentation (experimental data suite)
  - Measure fluid flow, motions, dynamic loads, stresses, and speed/power requirements
- Lifting Body
  - Designed to accept underwater lifting body(s) for hydrodynamic experimentation
- Drag Reduction
  - Advanced polymer active drag reduction system installed on lifting body

Technologies Insertion

- Lifting Body
- Fluid Drag Reduction/Polymers
- Modular Payloads in Mission Bay
- Modular payloads integrated into C4I
- UAVs/USVs/UUVs Capability
- Reduced Manning/Automation
- Gas Turbines/Diesels/Waterjets



X-Craft Performance Specifications

Length/Beam:	73 m / 22 m (approx)
FLD:	1150 LT (approx)
Propulsion:	(2) Gas Turbine Engines
	(2) Propulsion Diesels (CODOG)
Propulsor:	(4) Waterjets (steerable/reversible)
Speed:	≥ 50 knots in calm seas in Combat Loading Condition*
	40 knots in Sea State 4
Range:	4000 NM/trans-oceanic range @ 20 knots
C^4I:	(2) COTS surface search radars; LAN; HF, VHF, UHF radios
Survivability:	Operational through S/S 4; survivable through S/S 6
Mission Bay:	Support mission packages in ISO 20'x8'x8' containers
	- multi-purpose stern ramp (launch/recover up to 11m RHIBs)
	- side RO/RO ramp (support fully loaded HMMWV)
Flight Deck:	Landing spots for (2) SH-60Rs (day/night VFR)
	No maintenance facilities
Crew:	25
Initial Sea Trials:	June 2004

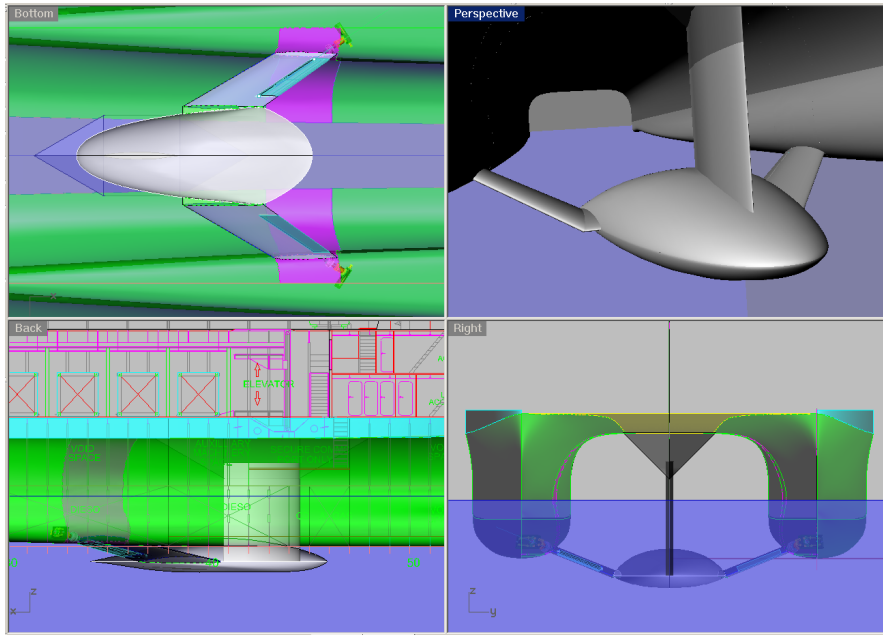
“Combat Loading” Condition

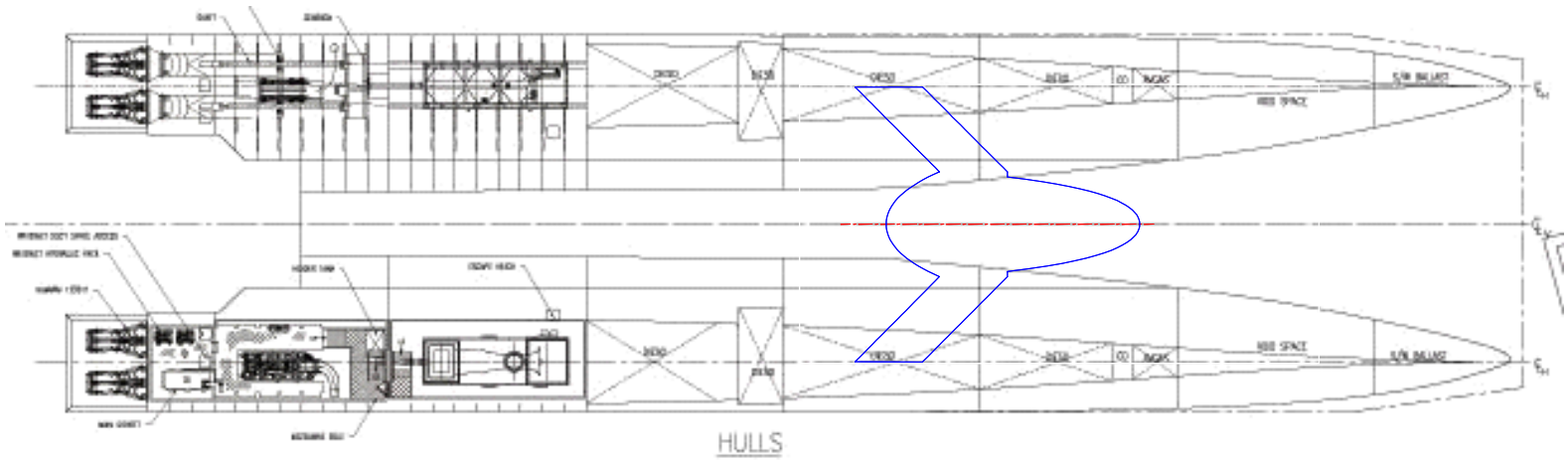
X-Craft shall achieve speeds of 50 knots (109°F ambient, 96°F seawater temp) in the “Combat Loading” Condition

- “Combat Load” Condition is the Light Ship Loading Condition plus 150 tons of payload and adequate fuel and stores to operate for 5 hours at 50 knots and 5 days at loiter speed (12 knots)

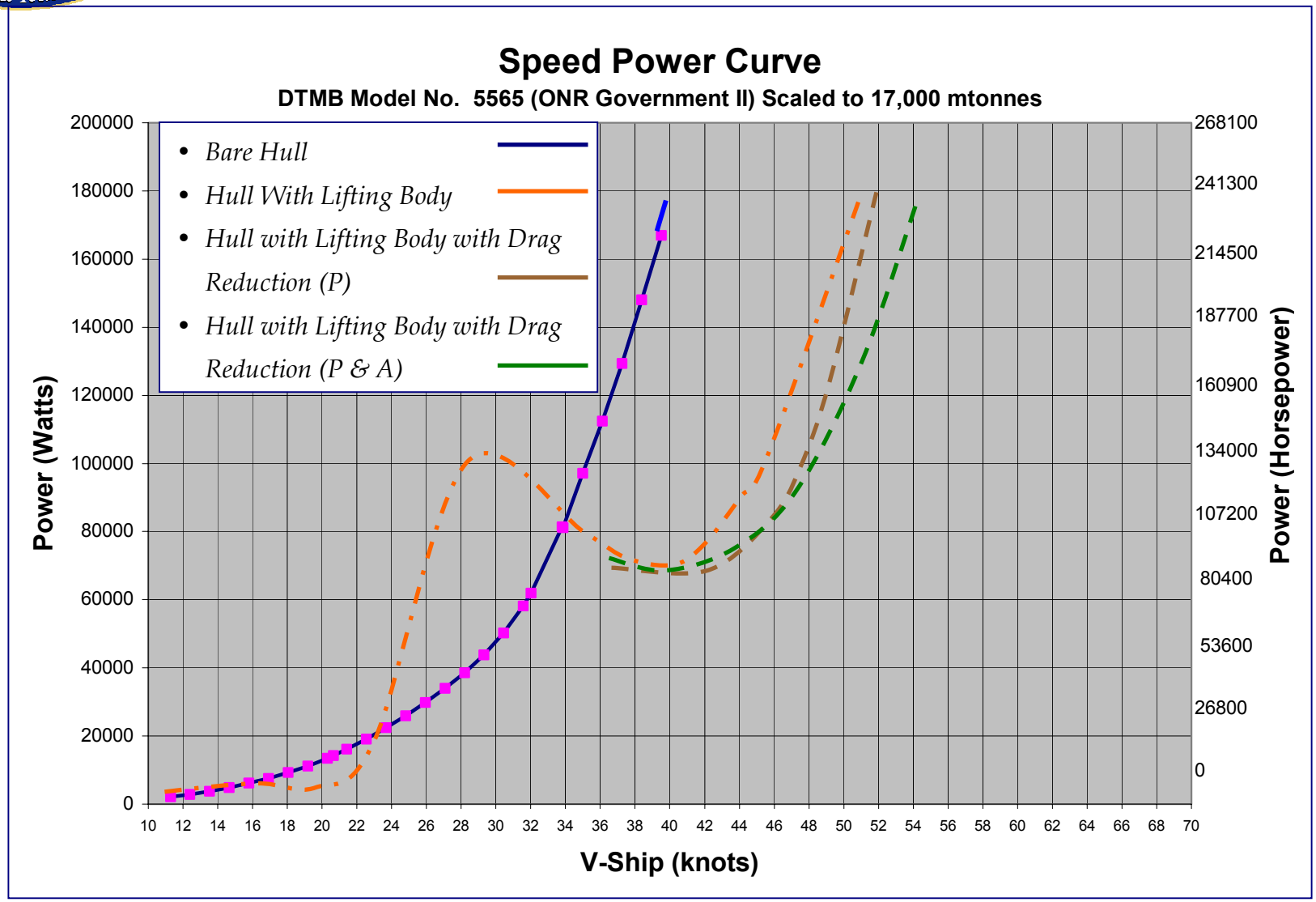
Lifting Body

- Lifting Body: Pacific Marine
- Drag Reduction: Cortana Corp.
  - Active polymer ejection system
  - Lifting Body only



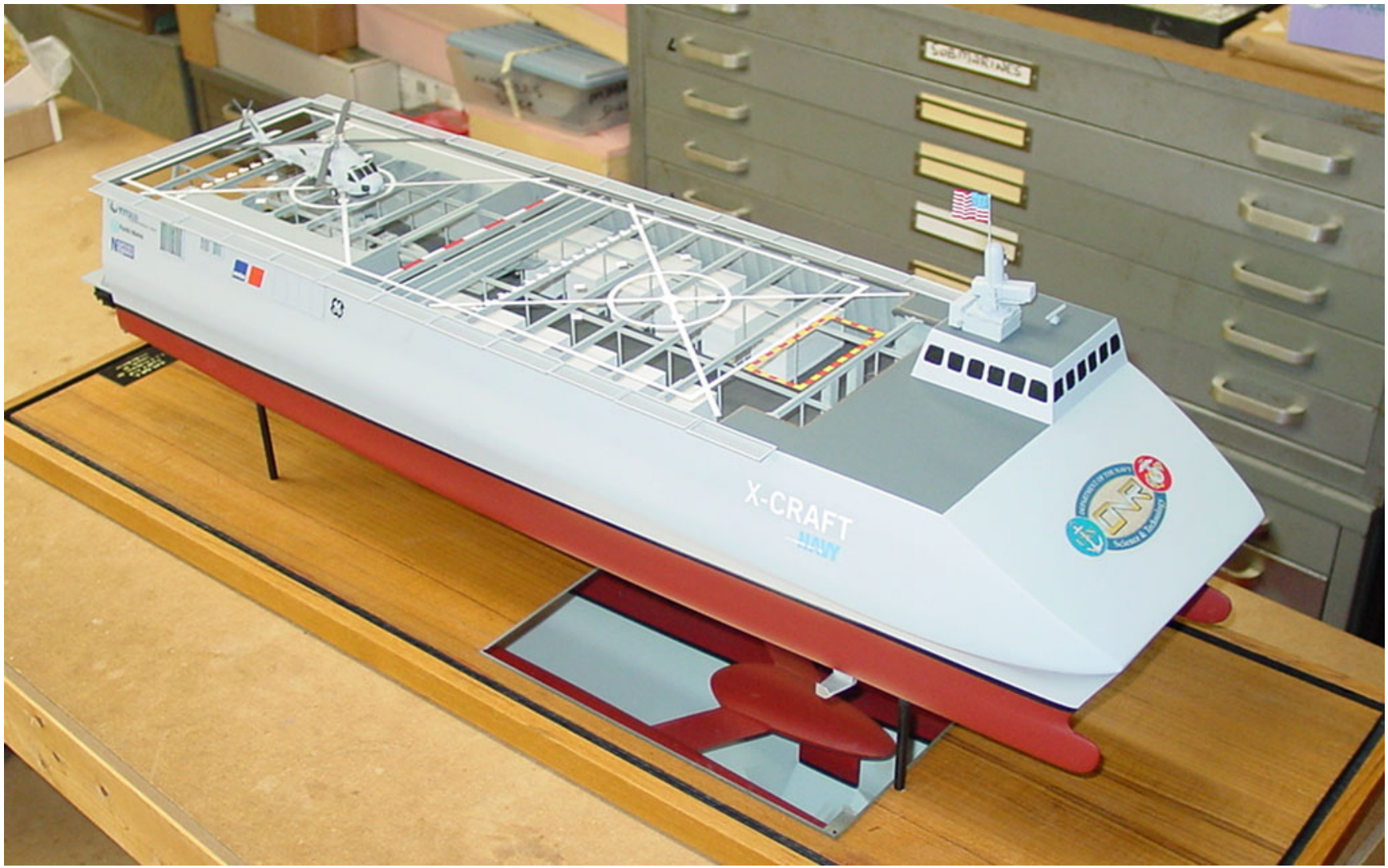


How the Contributors Can Add Up



Potential Operational Missions

- Modular Mission Package demonstrations
  - UAV/USV/UUV Launch & Recovery
  - Mine Counter-Measures
  - Humanitarian Support
- Battle Force Protection
- Helicopter “lily-pad” operations (refuel/re-arm)
- Logistics Support
- Special Operations Support
- Maritime Interdiction Operations


X-CRAFT
NAVY

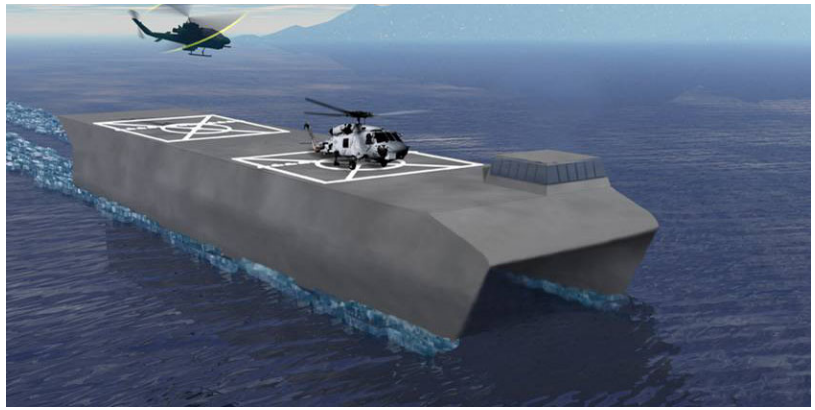
Current Status

- Keel laid June 2003
- On schedule for sea trials June 2004
- Detail design proceeding
- Gas turbines purchased and tested
- Stern ramp design ongoing
- Flight deck design/certification ongoing
- Ride control system design ongoing
- Certification package under development

Risk Areas

- Flight deck—attempting to achieve certification using NVG/NVD; no legacy lighting or navaids
- Manning—initial crew size of 16
- Stern ramp—design must be flexible enough to accommodate future boats and UVs; launch and recovery at higher speeds desired
- Certification—stability with and without lifting body; effect of high speed/sea state on vessel, crew and operations
- Funding—continue Congressional support required to fully fund vessel and lifting body

X- Craft



Propulsion

Metrics:
- Power Density
- Efficiency

Technologies:
- Engine / Drivetrain
- Mechanical drive vs. electric drive
- Propulsor choice

High power density CODOG plant with water jet propulsion

Hull Forms

Metrics:
- Minimize drag (friction, form, and wavemaking)

Technologies:
- Optimize hull form
- Control immersion (dynamic lift)
- Fluid drag reduction

Advanced catamaran hull. Lifting body with polymer drag reduction to be added later

Hull Materials

Metrics:
- Strength vs. weight
- Cost
- Corrosion resistance
- Reparability

Technologies:
- High strength steel
- Aluminum
- Composites
- Coatings

Evaluation of high strength aluminum welding and repair techniques

Ride Control

Metrics:
- Stable, smooth
- Controllable / adjustable

Technologies:
- Environmental sensing
- Algorithms
- Control surfaces and actuators

Advanced ride control system

Other ONR Vessels

ONR Small Vessel Programs span many of the key technologies needed for future small, fast craft – manned and unmanned.

Propulsion

Metrics:
- Power Density
- Efficiency

Technologies:
- Engine / Drivetrain
- Mechanical drive vs. electric drive
- Propulsor choice

Hull Forms

Metrics:
- Minimize drag (friction, form, and wavemaking)

Technologies:
- Optimize hull form
- Control immersion (dynamic lift)
- Fluid drag reduction

Hull Materials

Metrics:
- Strength vs. weight
- Cost
- Corrosion resistance
- Reparability

Technologies:
- High strength steel
- Aluminum
- Composites
- Coatings

Ride Control

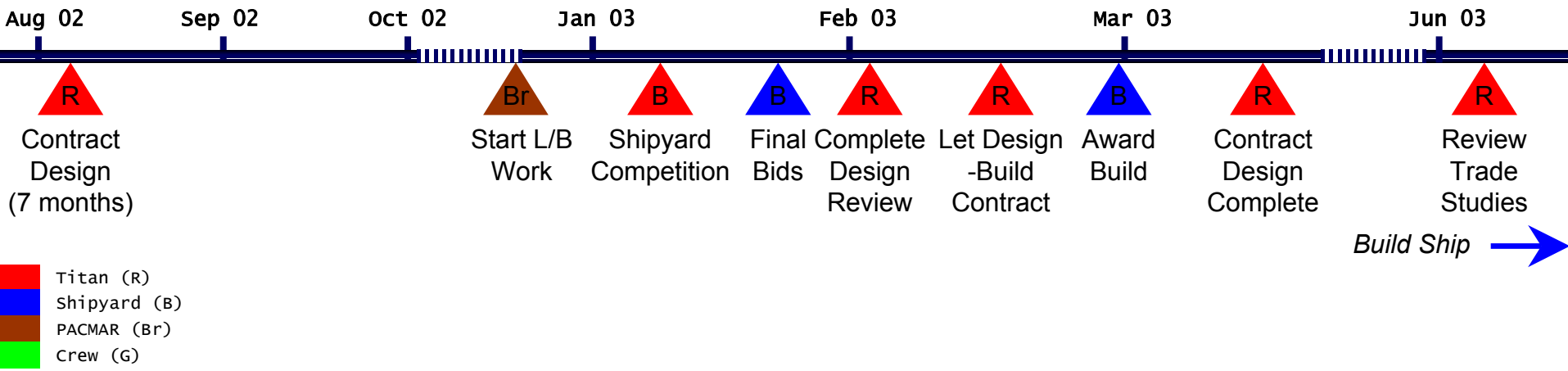
Metrics:
- Stable, smooth
- Controllable / adjustable

Technologies:
- Environmental sensing
- Algorithms
- Control surfaces and actuators

HYSWAC	X	X		X
HDV 100	X	X		X
X-Craft	X	X	X	X
CHSV			X	
HSCC	X	X		
SWCD	X	X		X
USSV	X	X	X	X

X-Craft Schedule

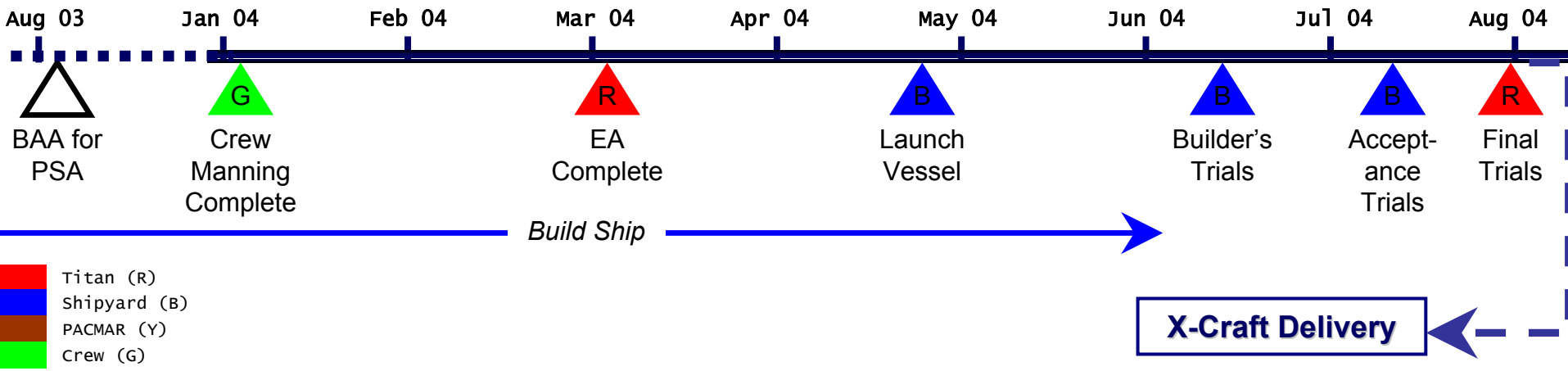
Contract Design → Build Ship



- Aug 02: Contract Design (6 months)
- 26 Dec 02: Start Lifting Body Work
- Dec 02: Initiate Shipyard Competition
- 17 Jan 03: Final Shipyard Bids
- 14 Feb 03: Complete Design Review
- 24 Feb 03: Let Design/Build Contract
- 28 Feb 03: Award Build Contract
- Mar 03: Contract Design Completed
- Jun 03: Build Ship (12 months)
- Jun 03: Review Trade Studies

X-Craft Schedule

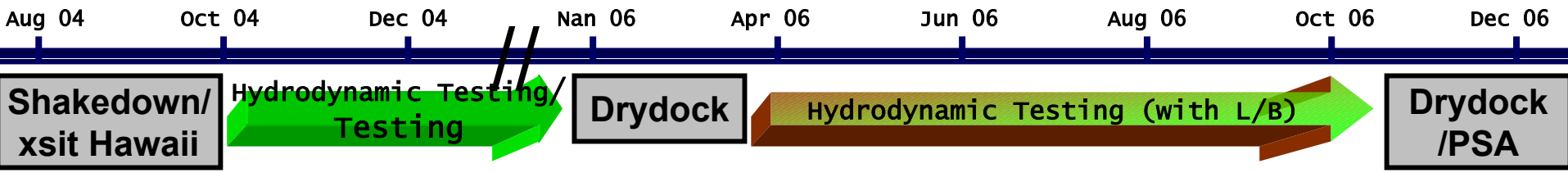
Build Ship ⟶ Delivery



- Aug 03: BAA for Post-Shakedown Availability (PSA)
- Jan 04: Crew Manning Complete
- Mar 04: Environmental Assessment Complete
- Apr 04: Launch Vessel
- 15 Jun 04: Builder's Trials (1 week)
- 08 Jul 04: Acceptance Trials (1 week)
- Aug 04: Final Contract Trials
- 11 Aug 04: X-Craft Delivery

X-Craft Schedule (S&T Phase)

Delivery → PSA



PACMAR
Crew

- Aug 04: Shakedown/Transit to San Diego
- Oct 04: Commence Hydrodynamic Testing (without Lifting Body) ~ 3 months
- Jan 05: Initial Operational Concept Development
- Jan 06 Drydock/Install Lifting Body
- Feb 06: Commence Hydrodynamic Testing (with Lifting Body) – 7 months
- Oct 06: Drydock/Remove Lifting Body /Commence Post-Shakedown Availability (PSA)

X-Craft Organization

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Dep. Ship Design Mgr	Dr. Bernard Koehr	NSWC Carderock	(703) 696-0486	koehrb@onr.navy.mil

Naval Architect	Nigel Gee & Associates	Southampton, United Kingdom
Prime Contractor	Titan Corporation	San Diego, CA
Shipyard	Nichols Bros Boat Builders	Freeland, WA
Lifting Body	Pacific Marine	Honolulu, HI
Drag Reduction	Cortana Corporation	Falls Church, VA